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Standard Practice for Radiological and Nuclear Emergency Response[1]

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INTRODUCTION

~~One of the legacies of the Oklahoma City bombing and~~ Terrorist attacks around the world, including the attacks of September 11, ~~2001 is recognition that terrorists use~~ 2001, and the continued proliferation of nuclear weapons bring the recognition that weapons of mass destruction ~~(WMD). This awareness has changed the philosophy of emergency response across disciplines.~~ (WMD), including the threats posed by radiological and nuclear weapons, remain a relevant concern. Since the attacks of 2001 and subsequent expressions of interest in acquiring radiological or nuclear weapons, or both, by terrorist groups and nation states, many jurisdictions have recognized the need for radiological and nuclear emergency preparedness. Incident response is still based on accepted procedures and safe work practices developed over the years, but ~~the new mission must include concerns that are specific to~~ it has become the norm to plan for both accidents and an intentional release of hazardous materials (including radioactive materials) designed to kill or ~~injure and~~injure, to cause destruction of ~~property. This standard~~ property, or to deny access to areas, or combinations thereof. This practice provides guidance for ~~responding to incidents where radioactive materials might be used with that intent. The standard also applies guidance for general radiological emergency response. The purpose of the guidance is~~ the initial response to any type of incident complicated by radiation, and the basic radiation principles described will enable responders to perform their duties to save lives, ~~minimize radiation dose, and move members of the public out of perceived danger areas.~~protect the public and minimize radiation dose in keeping with the ALARA principle; however, this practice is not intended to replace the large body of work that has already been developed that addresses responses to accidents at commercial nuclear power plants, nuclear detonations, or large-scale radiological incidents and those that are included in the list of references.

This ~~standard~~ practice provides decision making considerations that jurisdictions can use to respond to incidents that involve ~~radioactive materials. The standard practice~~ radiological or nuclear materials. This practice also provides a consistent set of practices that can be incorporated into the development, planning, training, and implementation of guidelines for radiological emergency response. ~~The standard~~While the practice does not ~~incorporate long-term recovery or mitigation considerations, nor does it include provisions for improvised nuclear device~~fully treat the complexities of large-scale radiological (for example, a radiological attack) or nuclear (for ~~(INDs) detonations or~~ example, a nuclear attack) incidents, or commercial nuclear power plant (NPP) ~~accidents. Jurisdictions using the standard practice shall incorporate~~ accidents, it refers jurisdictions to recent guidance documents and practices to incorporate into their own procedures for ~~notification and requests for assistance from specialized radiological response assets.~~an initial response, with the assumption that concurrent requests are made to summon specialized regional, state, and federal radiological expertise and equipment, as appropriate to the incident. This practice does not incorporate intermediate or long-term recovery or mitigation considerations.

[1] This practice is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.01 on CBRNE Detection and CBRN Protection.

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The following are key concepts associated with this ~~standard practice:~~practice:

~~The standard~~• This practice applies to the ~~emergency phase of an event (0 to 24 h or until specialized resources arrive on scene if they are~~initial response to an incident, which begins with the recognition of the radiological or nuclear nature of the incident and ends when emergency response actions cease or the response is supported by specialized regional, state, or federal response assets (if requested).

• In the first hours of the response, it is unlikely that significant levels of federal and state support will be on scene. This means that State, Local, Tribal, and Territorial (SLTT) jurisdictions and agencies must rely on their own immediately available assets, technical equipment, and training.

• This practice recognizes that response to all radiological incidents calls for assessing the risks to responders to determine whether the prospective benefit(s) justify an offensive mode of operations, and that response to a nuclear detonation calls for immediate sheltering for all emergency responders who do not have radiation detection equipment available;

• It adheres to a risk-based response; this means the guidance presented is intended to be coupled with the authority having jurisdiction's ~~(AHJ's)~~(AHJ) understanding of local ~~vulnerability and capability~~hazards, vulnerabilities, and capabilities when developing its plans and guidance documents on the ~~subject.~~subject;

• It is compliant with the National Incident Management System (NIMS) and uses Incident Command System (ICS) common terminology. Full compliance with NIMS is recognized as an essential part of emergency response ~~planning. In developing this standard practice, every effort was made to ensure that all communications between organizational elements during an incident are presented in plain language according to NIMS 2007. In keeping with this NIMS requirement, key definitions and terms, using plain English, are incorporated.~~planning;

• It uses plain language: in developing this practice, every effort was made to ensure that the text, including definitions, is presented in plain language according to Ref (**1**);[2]

• It acknowledges that response to a nuclear incident is far more complex than a radiological response and will require a different level of effort, time, and available resources to resolve;

• It notes that only a nuclear detonation requires responders to immediately seek shelter (if they have radiation detection instruments), to conduct only quick, critical lifesaving activities outside in areas where radiation exposure rates are greater than 10 R/h (if they have radiation instruments) or, if without radiation instruments, to remain in shelter until they are instructed to respond or relocate by an appropriate person in their chain of command (X4.2.2);

• While the dose accrued in an emergency is not subject to regulatory requirements and it is desirable to keep below 5 rem, in an emergency this may not be possible. This standard recognizes the dose in an emergency is managed under the Environmental Protection Agency guidance described in Section 4 and not by occupational limits. In addition to the Environmental Protection Agency guidance, there are numerous supporting references in this practice to implement that guidance, as cited in the paragraph below. In addition, Chapter 7 in Ref (**2**) contains a comprehensive discussion on the status of emergency workers with regulations and guidance (**1**);

~~It is not intended for large-scale nuclear scenarios (for example, IND),~~• It is consistent with other planning guidance documents such as: Refs ~~which~~ (**2-6**~~may~~)~~quickly exhaust the capabilities of local emergency responders.~~;

~~The standard practice~~ • It is intended to complement existing guidance (for example, Ref (**7**)) but it is not intended to ~~prepare communities for~~ replace existing guidance for responding to commercial nuclear power plant accidents. The state of preparedness for communities in close proximity to nuclear power plants far exceeds the minimum requirements and capabilities described in this ~~standard practice.~~practice; and

~~TRACEM (Thermal, Radiological, Asphyxiant, Chemical, Etiological, Mechanical) issues were considered throughout. While response to radiological hazards is the focus of this standard practice, responders must consider all hazards during a response; it is possible that non-radiological hazards may present a greater danger at an incident.~~

~~The standard practice does not address airborne contamination levels of radioactive materials exposure. Equipment to determine this potential hazard is not widely available in emergency responder communities. Respiratory protection is required for emergency responders until a complete~~

[2] ~~An improvised nuclear device is defined as follows: A device incorporating fissile materials designed or constructed outside of an official government agency and that has, or appears to have, or is claimed to have the capability to produce a nuclear explosion. It also may be a nuclear weapon that is no longer in the custody of competent authority or custodian, or has been modified from its designated firing sequence, or it may have been assembled from illegally obtained nuclear weapons components or special nuclear materials.~~The boldface numbers in parentheses refer to a list of references at the end of this standard.

~~hazard identification assessment is complete.~~• It emphasizes the importance of working with or consulting with radiation safety professionals throughout the process of incorporating the contents of this practice into radiological and nuclear emergency response plans.

1. Scope

1.1 This practice provides decision-making considerations for response to both accidental and intentional incidents that involve radioactive ~~materials.~~material. It provides information and guidance for what to include in response ~~planning,~~planning and what activities to conduct during a response. ~~The scope of this standard practice does not explicitly consider response to INDs or nuclear power plant accidents.~~It also encompasses the practices to respond to any situation complicated by ~~It does not expressly address emergency response to contamination of food or water supplies.~~ radiation in conjunction with the associated guidance for the specific type of incident.

1.1.1 The intended audience for the standard includes planners as well as emergency responders, incident commanders, and other emergency workers who should be protected from radiation.

1.1.2 The scope of this practice applies to all types of radiological emergencies. While it does not fully consider response to an NPP accident,[3] an explosive RDD, or nuclear detonation, detailed guidance to respond to such incidents is provided in other documents, such as those cited in the introduction. With respect to the guidance documents, this practice provides the general principles that apply to the broad range of incidents and associated planning goals but relies on the AHJ to apply and tailor their response planning based on those documents as well as the limitation of the personnel and equipment resources in the jurisdiction. In addition, the AHJ should use those documents to identify improvements to planning and resources to be better prepared for the more complex emergencies.

1.1.3 This practice does not expressly address emergency response to contamination of food or water supplies.

1.1.4 The Emergency Response Guide (ERG) published by the Department of Transportation provides valuable information for response to traffic accidents involving radioactive materials. For other radiological or nuclear incidents, however, the ERG may not provide adequate information on appropriate protective measures and should not be the sole resource used.

1.2 This practice applies to those emergency response agencies that have a role in the response to ~~a radiological incident, excluding an IND~~ an accidental or intentional radiological or nuclear incident. It should be used ~~in~~by emergency ~~services~~ response organizations such as law enforcement, fire ~~department, and emergency medical response actions.~~ service, emergency medical services, and emergency management.

1.3 This practice assumes that implementation begins with the recognition of a radiological or nuclear incident and ends when emergency response actions cease or the response is ~~assumed~~supported by specialized regional, state, or federal response ~~teams.~~assets.

1.4 AHJs using this practice ~~will~~should identify hazards, develop a plan, acquire and track equipment, and provide training consistent with the descriptions provided in Section 6. ~~AHJs not able to meet the requirements should refer to the United States (US) Department of Transportation (DOT) Emergency Response Guidebook (ERG) for guidance on how to manage radiological incidents (DOT, current version). This standard practice provides additional guidance and is not intended to replace the ERG, rather to supplement it (see Annex A1).~~

1.5 While response to radiological hazards is the focus of this practice, responders must consider all hazards during a response; it is possible that non-radiological hazards may present a greater danger at an incident, particularly in incidents with wide area dispersion.

1.5.1 This practice does not fully address assessing the risks from airborne radioactivity. Equipment to determine this potential hazard is not widely available in emergency responder communities. Like other responses to unknown hazards, respiratory protection commonly used by responders is required until a complete hazard identification assessment is complete.

[3] Local response to nuclear ~~facilities~~facility incidents should follow nuclear facility ~~plans, especially in accordance to ingestion pathway zone actions, such as distribution of potassium iodine.~~plans.

1.6 This practice is divided into the following sections:

Section	Title
1	Scope
2	Referenced Documents
3	Terminology
4	Summary of Practice
5	Significance and Use
6	Prerequisites for Radiological or Nuclear Emergency Response
7	Nuclear Detonation Response
8	Radiological Emergency Response
Appendix X1	Operational Guidance for Responding to Radiological or Nuclear Incidents, or both, and Emergencies
Appendix X2	Summary of Blast and Radiation Zones Following a Nuclear Detonation
Appendix X3	Practicing ALARA Using Time, Distance, and Shielding: Determining Radiological Dose
Appendix X4	Radiological Emergency Response Guidelines
Appendix X5	Emergency Response Checklist for Radiological Incidents
Appendix X6	Radiation Detection Instruments
Appendix X7	Example Radiation Safety Procedures
Appendix X8	Sample Radiation Safety Procedures
Appendix X9	Training Resources
Appendix X10	Radiation Units, Conversions, and Abbreviations
N/A	References
N/A	Bibliography

1.7 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.8 *This standard ~~practice~~ does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard ~~practice~~ to establish appropriate ~~safety and health~~safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *Federal Standards:*[4]

10 CFR 20.1001 Standards for Protection Against Radiation

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926.502 Occupational Safety and Health Standards

49 CFR 173 Shippers General Requirements for Shipments and Packages

18 U.S. Code §2332a Use of weapons of mass destruction

29 U.S. Code §654 Duties of employers and employees

2.2 ~~*Referenced Standards and Documents:*~~*IEEE/ANSI Standards:*[5]

~~ANSI N42.33~~IEEE/ANSI N42.17AC ~~American National Standard for Portable Radiation Detection Instrumentation for Homeland Security~~Performance Specifications for Health Physics Instrumentation-Portable Survey Instrumentation for Use in Normal and Extreme Environmental Conditions

~~ANSI~~IEEE/ANSI N42.32 ~~American National Standard~~ Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security

IEEE/ANSI N42.33 Portable Radiation Detection Instrumentation for Homeland Security

IEEE/ANSI N42.37 Training Requirements for Homeland Security Purposes using Radiation Detection Instrumentation for Interdiction and Prevention

IEEE/ANSI N42.42 American National Standard Data Format for Radiation Detectors Used for Homeland Security

~~ANSI~~IEEE/ANSI, N42.49A ~~American National Standard for~~ Performance Criteria for Alarming Electronic Personal Emergency Radiation Detectors (PERDs) for Exposure Control

~~CDC 2007 Population Monitoring in Radiation Emergencies: A Guide for State and Local Public Health Planners~~[6]

~~CRCPD 2006 Radiological Dispersal Device (RDD)—First Responder's Guide, the First 12 Hours~~[7]

~~CTOS 2014 WMD Definitions for Use in the DHS Course Materials Developed by CTOS~~[8]

~~29 CFR 1910 Occupational Safety and Health Standards~~[9]

[4] Available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, http://www.gpo.gov.

[5] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., Piscataway, NJ 08854-4141, http://www.ieee.org.

49 CFR 173 Shippers General Requirements for Shipments and Packages[9]
DOT, current version, Emergency Response Guidelines (ERG)[10]
EPA 400-R-92-001 Manual of Protective Action Guides and Protective Actions for Nuclear Incidents[11]
EPA PAG Manual Protective Actions Guides and Planning Guidance for Radiological Incidents, 2013 (Draft for Interim Use and Public Comment)[11]
EPA-402-F-07-008 Communicating Radiation Risks, Office of Radiation and Indoor Air[11]
FEMA 2008 Application of Protective Action Guides for Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents[12]
Homeland Security Act of 2002 [13]
IAEA 2006 Manual for First Responders to a Radiological Emergency[14]
ICRP Publication 96 Protecting People against Radiation Exposure in the Event of a Radiological Attack, 96[15]
NCRP Commentary No. 19 Key Elements of Preparing Emergency Responders for Nuclear and Radiological Terrorism[16]
NCRP Report No. 138 Management of Terrorist Events Involving Radioactive Material[16]
NCRP Report No. 116 Limitation of Exposure to Ionizing Radiation[16]
NCRP Report No. 165 Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers[16]
NFPA 472 Standard for Professional Competence of Responders to Hazardous Materials Incidents[17]
NIMS 2007 Draft revised NIMS for interim use[18]
NRF 2008 [19]
NIST 2006a Results of Test and Evaluation of Commercially Available Survey Meters for the Department of Homeland Security—Round 2[20]
NIST 2006b Results of Test and Evaluation of Commercially Available Personal Radiation Detectors (PRDs) and Radiation Pagers for the Department of Homeland Security—Round 2[20]
NIST 2005a Results of Test and Evaluation of Commercially Available Survey Meters for the Department of Homeland Security[20]
NIST 2005b Results of Test and Evaluation of Commercially Available Personal Radiation Detectors (PRDs) and Radiation Pagers for the Department of Homeland Security[20]
NUREG-0654/FEMA-REP-1, Rev. 1 AddendaIEEE/ANSI N42.49B Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, Final ReportPerformance Criteria for Non-alarming Personal Emergency Radiation Detectors (PERDs) for Exposure Control
NUREG-0654/FEMA-REP-1IEEE/ANSI N323AB Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power PlantsStandard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments (Revision and Redesignation of IEEE/ANSI N323A-1997 and IEEE/ANSI N323B-2002)

2.3 *NFPA Standards:*[6]

NFPA 470 Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders
NFPA 472 Standard for Competence of Responders to Hazardous Materials Incidents
NFPA 3000 Standard for an Active Shooter/Hostile Event Response (ASHER) Program
NFPA Glossary of Terms (2021)

2.4 *Other Standards:*

ANSI/HPS N13.36 Radiation Safety Training for Workers[7]
EPA-402-K-22-008 Communicating Radiation Risks, Office of Radiation and Indoor Air[8]

3. Terminology

3.1 *Definitions:*

3.1.1 *authority having jurisdiction (AHJ)—Active Shooter/Hostile Event (ASHE), n—*the organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.an incident involving one or more individuals who are or have been actively engaged in harming, killing, or attempting to kill people in a populated area by means such as firearms, explosives, toxic substances, vehicles, edged weapons, fire, or a combination thereof. **NFPA 472323000 (2021a)**

3.1.2 *ALARA (as low as reasonably achievable)—achievable), n—*a principle of radiation protection philosophy that requires that exposures to ionizing radiation should be kept as low as reasonably achievable, economic and social factors being taken into

[6] Annex A1 material is labeled to complement the standard practice section numbers and can be found at the end of the standard before the appendices. The annex provides additional information for responder consideration. Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.
[7] Available from http://standards.ieee.org/getN42/. American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[8] For access to document, go to http://www.bt.cdc.gov/radiation/pdf/population-monitoring-guide.pdf. Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.

account; the ALARA principle is satisfied when the expenditure of further resources would be unwarranted by the reduction in exposure that would be ~~achieved.~~achieved (**8**). ~~**NCRP Report No. 165**~~

3.1.3 *authority having jurisdiction (AHJ), n*—an entity that can create and administer processes to qualify, certify, and credential personnel for incident-related positions. AHJs include state, tribal, or federal government departments and agencies, training commissions, NGOs, or companies, as well as local organizations such as police, fire, public health, or public works departments (**1**).

3.1.4 ~~*committed effective dose equivalent*~~*community reception center (CRC),* ~~*(CEDE)—*~~*n—* ~~committed effective dose equivalent is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.~~non-medical facility established to monitor members of the public for radioactive contamination and to provide decontamination if necessary (**8**).

3.1.5 *dangerous radiation zone, n*—an area where radiation levels exceed 10 R/h (0.1 Gy/h) (**8**).

3.1.6 *decision* ~~*points—*~~*points, n—*predefined exposure rates or ~~doses~~exposures at which a decision-maker must determine a path forward to maximize responder safety and public ~~protection.~~protection (**9**).

3.1.7 ~~*decontamination—*~~*decontamination, n—*~~*(1*~~*(1)* the removal of radionuclide contaminants from surfaces (for example, skin) by cleaning and washing ~~(NCRP **Report No. 165);**~~ (**8**); ~~*2*~~*(2)* the physical or ~~chemical~~ chemical, or both, process of reducing and preventing the spread and effects of contaminants ~~from~~to people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) ~~incidents (2013 Edition NFPA 472 3.3.17).~~ incidents. **NFPA 470**

3.1.8 *defensive mode, n*—an operating mode characterized as medium risk to emergency responders, in which responders do not have direct contact with the hazardous materials/weapons of mass destruction (WMD), focusing on safely controlling or limiting the effects of a release. **NFPA 470**

3.1.9 ~~*defensive*~~*dose,* ~~*operation(s)—*~~*n—*~~emergency response measures taken from a safe distance (for example, outside the hot zone) to prevent or limit radiation exposure or the spread of hazardous material; life-safety operations are not a concern if defensive operations are the only~~a general term denoting the quantity of energy from ionizing radiation absorbed in a tissue or organ from either an external source or from radionuclides in the body ~~**operations**~~ (**10**~~**supporting**~~).~~the response.~~

3.1.10 ~~*dose—*~~*dose rate (also exposure rate), n—*~~radiation absorbed by an individual's body; general term used to denote mean absorbed dose, equivalent dose, effective dose, or effective equivalent dose, and to denote dose received or committed dose;~~a measure of dose delivered per unit time; dose rate can refer to any dose quantity (for example, absorbed dose, dose equivalent); dose rate is measured in units of R/h, mR/h, microR/h, and so forth with other units of radiation exposure and dose (rem, Sv, Gy, etc.) ~~**see**~~ (**8**~~**Total**~~).~~Effective Dose Equivalent (TEDE).~~ ~~**CRCPD 2006**~~

3.1.11 ~~*dosimeter—*~~*dosimeter, n—*a small, portable instrument (such as a film badge, thermoluminescent dosimeter, or pocket dosimeter) used to measure and record the total accumulated personal dose of ionizing ~~radiation.~~radiation (**11**). ~~**U.S. NRC Glossary**~~

3.1.12 ~~*emergency*~~*dosimetry,* ~~*decontamination—*~~*n—*the ~~physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor. A goal of emergency decontamination is reducing dose to a lower level; however it may not be possible to completely eliminate~~science or technique of determining radiation dose; strictly speaking, involving measured quantities, but also used informally to mean "dose assessment" (that is, involving measurements or theoretical calculations, or both) ~~**contamination.**~~(**2**).

3.1.13 *emergency operations center* ~~*(EOC)—*~~*(EOC), n—*~~the physical location at which the coordination of information and resources to support incident management activities normally takes place. An EOC may be a temporary facility or in a permanently established location in a~~a facility from which staff provide information management, resource allocation and tracking, or advanced planning support to personnel on scene or at other EOCs (for example, a state center supporting a local center), or combinations thereof ~~**jurisdiction.**~~(**1**). ~~**NIMS 2007**~~

~~3.1.11 *emergency responder*—emergency response providers include federal, state, and local government, fire, law enforcement, emergency medical, and related personnel, agencies, and authorities. **Homeland Security Act of 2002**~~

3.1.14 *emergency ~~response~~—response, n*—the performance of actions to mitigate the consequences of an emergency for human health and safety, quality of life, the ~~environment and property. It~~environment, and property; it may also provide a basis for the resumption of normal social and economic ~~activity.~~activity **(12).** ~~**IAEA 2006**~~

3.1.15 *emergency response personnel (emergency response provider), n—(1)* personnel assigned to organizations that have the responsibility for responding to hazardous materials emergencies (NFPA Glossary of Terms); *(2)* federal, state, and local emergency public safety, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities **(13)**.

3.1.16 *emergency worker, n*—anyone with a role in responding to the incident, whether a radiation worker previously or not, who should be protected from radiation exposure **(14)**.

3.1.17 ~~*evacuation—*~~*evacuation, n*—organized, phased, and supervised withdrawal, dispersal, or removal of ~~civilians~~people from dangerous or potentially dangerous areas, and their reception and care in safe ~~areas.~~areas **(1).** ~~**NIMS 2007**~~

3.1.18 *high exposure ~~rate—~~rate, n*—exposure rate beyond which emergency response is not recommended for rescue operations unless the incident commander (IC) determines it can be carefully controlled for a short duration for priority operations ~~such as life-saving,~~(for example, lifesaving), and the emergency responder is informed of the hazards and consents to performing the operation(s); the recommendation of this ~~standard practice is for a high exposure rate less~~ practice is that areas in which exposure rate is greater than or equal to 100 R/h ~~(1~~(1 Gy ~~Sv/h). For~~ /h) be considered to have a high exposure rate; for the purposes of this ~~standard~~ practice, the term "high dose rate" is equivalent to "high exposure ~~rate."~~rate" **(12).**

3.1.19 *hot ~~zone—~~spot, n*—the ~~control zone immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone.~~region in a radiation/contamination area where the level of radiation/contamination is significantly greater than in neighboring regions in the area **(11).** ~~**NFPA 472**~~

3.1.19.1 *Discussion—*

A hot spot is a localized area with elevated radiation or contamination levels, or both, while a "zone" (for example, dangerous radiation zone) is an extended area. Thus, while the hot zone might have local areas in which radiation exposure rates exceed 10 R/h, these local areas will be posted as "hot spots" within the much larger hot zone.

3.1.20 *hot ~~line—~~zone, n*—~~the line of~~an area where ~~*demarcation(1)* that may become a decision point to control~~radiation levels exceed 10 mR/h (0.1 mGy/h); or ~~*the(2)* hot zone; for a radiological~~contamination levels exceed 60 000 dpm/cm^2 ~~response, the hot line shall correspond to a previously established exposure rate (for example, the low exposure rate)~~beta and gamma at 1.5 cm (~0.5 in.) from the surface being surveyed; or *(3)*~~contamination level above which~~ alpha contamination levels exceed 6000 dpm/cm^2 at a distance of 0.5 cm (~0.25 in.) from the surface being surveyed, as measured with an alpha probe **(8, 15, 16)**~~personnel shall be trained and protected appropriately by~~ ; all personnel working in the hot zone must receive training and wear personal protective equipment (PPE) ~~to operate. The location of the hot line may not be determined based on radiation exposure rate or contamination level if a higher hazard associated with the incident presents greater risk.~~appropriate for the risks (for example, contamination, dangerous atmosphere, radiation etc.) that are present.

3.1.21 *improvised nuclear device, ~~(IND)—~~n*—a device ~~incorporating fissile materials designed or constructed outside of an official government agency and that has, or appears to have, or is claimed to have the capability to~~ designed by terrorists to produce a nuclear ~~explosion. It also may be a nuclear weapon that is no longer~~ detonation; this includes stolen and subsequently modified nuclear weapons but does not include stockpiled weapons in the custody of ~~competent authority~~the military ~~**or**~~ (17~~**custodian,**~~).~~or has been modified from its designated firing sequence, or it may have been assembled from illegally obtained nuclear weapons components or special nuclear materials.~~ **CTOS 2014**~~

3.1.22 *incident command system (ICS), n*—a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure **(1)**.

3.1.23 *incident commander ~~(IC)—~~(IC), n—*the individual responsible for ~~all~~on-scene incident activities, including ~~the development of strategies and tactics and the ordering and release of resources. The IC~~developing incident objectives and ordering and releasing resources; the incident commander has overall authority and responsibility for conducting incident operations ~~and (1is).responsible for the management of all incident operations at the incident site~~ **NIMS 2007**

3.1.24 *~~jurisdiction—~~jurisdiction, n—*jurisdiction has two definitions depending on the context: *(1)* a *range or sphere of ~~authority.~~authority* ~~Public~~: public agencies have jurisdiction at an incident ~~within their area of responsibility. Jurisdictional~~ related to their legal responsibilities and authority; jurisdictional authority at an incident can be ~~political, geographic (for example, city, county, tribal, state, or~~political or geographical (for example, local, state, tribal, territorial, and federal boundary lines) or functional (for example, law enforcement, public ~~health).~~health), or both; or *(2)* a *political subdivision*: (for example, municipality, county, parish, state, federal) with the responsibility for ensuring public safety, health, and welfare within its legal authorities and geographic boundaries **(1).** ~~**NIMS 2007**~~

3.1.25 *light damage zone (LDZ), n—*the area furthest from the site of a nuclear detonation, in which nearly all windows are shattered and building facades are damaged; most injuries in the LDZ are not life-threatening but there are likely to be many injuries from flying glass and debris **(4)**.

3.1.26 *low exposure ~~rate—~~rate, n—*~~the~~ radiation exposure rate ~~that marks the hot line if the radiation exposure hazard poses the greatest risk at an incident. It is recommended that the low exposure rate not exceed~~ less than 10 mR/h (milliR/h) (0.1 mSv/h (milliSv/h)) at 1 m (3.3 ft) from the object or at 1 m (3.3 ft) above the ground or ~~surface. For~~ surface being surveyed; for the purposes of this ~~standard~~ practice, the term "low dose rate" is equivalent to "low exposure rate."

3.1.27 *multiagency coordination system ~~(MACS)—~~(MACS), n—* ~~a system that provides the architecture to support coordination for incident prioritization, critical resource allocation, communications systems integration, and information coordination. The elements of the MACS include facilities, equipment, personnel, procedures, and communications. An EOC is a commonly used element. These systems assist agencies and organizations responding to an~~an overarching term for the NIMS Command and Coordination systems: the incident command system (ICS), emergency operations centers (EOCs), the multiagency coordination (MAC) group/policy groups, and joint information centers (JICs) ~~**incident.**~~**(1).** ~~**NIMS 2007**~~

3.1.28 *nonintervention mode, n—*an operating mode used where the risk to emergency responders is greater than the benefit, in which responders do not operate near the hazardous materials/weapons of mass destruction (WMD) or container, focusing on public protective actions only and allowing the container or product to take its natural course. **NFPA 470**

3.1.29 *offensive ~~operation(s)—~~mode, n—*~~emergency response measures taken to reduce or minimize exposure from hazardous circumstances and materials to responders and civilians (for example, operations required within the hot zone); life-safety operations are top priority in offensive operations however evidence preservation shall be considered.~~an operating mode characterized as higher risk to emergency responders, in which responders could have direct contact with the hazardous materials/weapons of mass destruction (WMD), taking aggressive actions to control the release of hazardous materials/WMD. **NFPA 470**

3.1.30 *orphan ~~source—~~source, n—*a radioactive source that is not under regulatory control, either because it has never been under regulatory control, or because it has been abandoned, lost, misplaced, stolen, or transferred without proper ~~authorization.~~authorization **(18).** ~~**ICRP Publication 96**~~

3.1.31 *personal emergency radiation detector ~~(PERD)—~~(PERD), n—*~~an alarming electronic radiation measurement instrument used to manage exposure by alerting the emergency responders when they are exposed to gamma radiation. The instrument provides rapid and clear indication of the level of radiation exposure (dose) or exposure rate (dose rate), or both, and readily recognizable alarms. The alarms are both audible and visual, and distinguishable between exposure rate and exposure.~~a high range, alarming, body-worn device capable of operating above 10 R/h and potentially up to 1000 R/h (0.1 Gy/h and potentially as high as 10 Gy/h). ~~**COTS 2014**~~**IEEE/ANSI N42.49A**

3.1.32 *personal protective equipment ~~(PPE)—~~(PPE), n—*the protective clothing and respiratory protective equipment provided to shield or isolate a person from ~~hazards (TRACEM) that can be~~ the hazards encountered at hazardous ~~materials/WMD incidents.~~materials/weapons of mass destruction incident operations. **NFPA ~~472~~Glossary of Terms**

3.1.33 *personal radiation detector (PRD)—(PRD), n—*a pocket-sized detection instrument worn by an operator to detect the presence of radiological/nuclear material in a limited area in the vicinity of the operator. PRDs detect small increases in gamma radiation above background levels and alert the operator. Some models have additional capabilities to measure gamma radiation exposure rate levels, measure the accumulated gamma radiation dose, or a limited capability to detect neutron radiation, or combinations thereof.PRD is a pocket-sized battery-powered alarming electronic instrument that is worn on the body and used to detect photon-emitting, and optionally neutron-emitting, radioactive materials; PRDs have user-readable displays related to the intensity of radiation, but they are distinct from, and typically more sensitive than, electronic personal dosimeters, which are designed to measure the dose equivalent to workers occupationally exposed to radiation. **CTOS 2014IEEE/ANSI N42.32-2016**

3.1.34 *preventive radiological/nuclear detection (PRND)* or *Radiological/Nuclear Detection (RND)—radiological/nuclear detection (RND), n—*capability to detect,detect illicit radiological/nuclear materials and radiological/nuclear WMDs at the points of manufacture, transportation, and use, and to identify the nature of material through adjudication or resolution of the detection alarm. Thisalarm; this does not include actions taken to respond to the consequences of the release of radiological/nuclear materials (such as response to the detonation of a Radiologicalan RDD **Dispersal** (**19Device).**).Also called Preventative Radiological/ Nuclear Detection (PRND) **CTOS 2014**

3.1.35 *radiation source, n—*radioactive material or byproduct that is specifically manufactured or obtained for the purpose of using the emitted radiation; such sources are commonly used in teletherapy or industrial radiography; in various types of industrial gauges, irradiators, and gamma knives; and as power sources for batteries (such as those used in spacecraft); these sources usually consist of a known quantity of radioactive material, which is encased in a manmade capsule, sealed between layers of nonradioactive material, or firmly bonded to a nonradioactive substrate to prevent radiation leakage (**11**).

3.1.35.1 *Discussion—*
For the purpose of this document a "legitimate" radiation source is a source of radiation that is being used in the manner intended (for example, radioactivity administered to a nuclear medicine patient, radioactivity present in a "nuclear" soil gauge in use at a construction site, etc.).

3.1.36 *radiological dispersal device (RDD)—(RDD), n—*any device that intentionally spreads radioactive material across an area with the intent to cause harm, without a nuclear explosion occurring. An RDD that uses explosives for spreading or dispersing radioactive material is called an "explosive RDD." The term "dirty bomb" is used by media, government, and others as a well-known, non-technical term for an explosive RDD. Non-explosive RDDs could a device designed to spread radioactive material using common items such as pressurized containers, fans, building air-handling systems, sprayers, crop dusters, or even spreading bythrough a detonation of conventional explosive or other (non-nuclear) means **hand.**(**9**). **CTOS 2014**

3.1.37 *radiation exposure device (RED)—(RED), n—*a device intended to cause harm by exposing people to radiation without spreading radioactive material. An example of a RED is unshielded or partially shielded radioactive material placed in any type of container and in a location capable of causing a radiation exposure to one or more individuals. Alsoconsisting of a large quantity of radioactive material clandestinely placed to expose people to ionizing radiation **called** (**8a**).“Radiological Exposure Device (RED).” **CTOS 2014**

3.1.38 *rem—rem, n—*a unit of biological/risk equivalent dose; not all radiation produces the same biological effect, even for the same amount of absorbed dose; rem relates (from Roentgen Equivalent Man) a measure of the biological damage caused by exposure to ionizing radiation, equal to the absorbed dose in human tissue to the effective biological damage of the radiation. For the purpose of this standard practice, the 1 rem of dose is equal to 10 mSv.rads multiplied by the radiation weighting factor for the type of radiation causing the exposure; 1 rem = 10 mSv (**8**).

3.1.39 *responder protection, n—*preventative measures taken to mitigate hostile actions against response personnel, resources, facilities, and critical information (**20**).

3.1.40 *roentgen (R)—(R), n—*a unit of exposure to ionizing radiation. It is the primary standard of measurement used in the emergency responder community inradiation as determined by measuring the amount of ionization produced in a small volume of air **the**(**21**) United States. For the ; for the purpose of this standard practice, 1 R of exposure is equal to 1 rem rem, 1 rad, and 10 mSv of dose to the human body.

~~1000 micro-roentgen (microR or uR) = 1 milli-roentgen (mR)~~
1000 micro-roentgen (microR or µR) = 1 milli-roentgen (mR)
1000 milli-roentgen (mR) = 1 roentgen (R), thus
1 000 000 microR = 1 roentgen (R)

3.1.40.1 *Discussion—*
To improve clarity in communications, the unit roentgen may be spoken as "R" instead of pronouncing "roentgen." The SI prefix "micro" (one millionth) may be written as a lower case "u" or the phrase "micro" instead of the lower case Greek letter mu (µ) and may be spoken as either "micro" or "U." Similarly, the SI prefix "milli" (one thousandth) may be written as either "milli" or "m" and spoken as either "milli" or "M." For example, the value of 25 µR may be written as "25 uR" or "25 microR" and pronounced as "25 U-R" or "25 micro-R." Likewise, the value of 2 mR could be spoken as "2 M-R" or "2 milli-R."

3.1.41 ~~*roentgen per hour (R/h)—*~~*safety officer (hazardous materials), n—*~~a unit used to express exposure per unit of time (exposure rate). For the purpose of this standard practice, the roentgen unit of exposure is assumed to be equivalent to the sievert unit of dose and "1 R = 10 mSv" will be applied as the basis for comparison of traditional and SI units. For the purpose of this standard practice, the term "dose rate" is equivalent to "exposure rate."~~the person who works within an incident command system (specifically, the hazardous materials branch/group) to ensure that recognized hazardous materials/weapons of mass destruction (WMD) safe practices are followed at hazardous materials/WMD incidents. **NFPA 470**

3.1.42 *secondary ~~threats—~~threats, n—*~~any object or person(s) designed to cause harm to persons responding to an~~secondary threats include armed personnel or explosive devices that are placed to cause casualties among emergency personnel responding to incidents ~~**incident**~~(22) ~~(emergency responders)~~; see also ~~*or to increase*~~ *Active Shooter/Hostile Event.*~~the number of civilian casualties. Secondary threats are normally designed to cause harm after persons have responded to the scene.~~

3.1.43 *shelter in ~~place—~~place, n—*~~taking shelter inside a structure and remaining there until the danger passes. Sheltering in-place is used when evacuating the public would cause greater risk than staying where they are, or when an evacuation cannot be performed.~~the strategy and tactics used to protect or shelter people or animals, or both, from a threat in a safe area, as an alternative to evacuation.

NFPA Glossary of Terms

3.1.44 ~~*technical*~~*termination, ~~decontamination—~~n—*~~the process designed to remove hazardous contaminants from responders and their equipment and victims. It is intended to minimize the spread of contamination and ensure responder safety. Technical decontamination is normally established in support of emergency responder entry operations at a hazardous materials incident, with the scope and level of technical decontamination based upon the type and properties of the contaminants involved. In non life-threatening contamination incidents, technical decontamination can also be used on victims of the initial release.~~ that portion of incident management after the cessation of tactical operations in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident.

NFPA ~~472~~Glossary of Terms

~~3.1.36 *termination—*termination in the context of this standard practice is the end of life safety operations, investigative work, and assurance of protective measure implementation. This will include documentation of hazards present and conditions found.~~

~~3.1.37 *TRACEM—*the acronym for additional hazards which may be found at any incident; derived from thermal, radiological, asphyxiant, chemical, etiological, and mechanical harms.~~

3.1.45 ~~*total*~~*terrorism, ~~effective~~ n—~~*dose equivalent (TEDE)—*~~ for the purpose of this standard practice,~~any activity that (A) involves an act that (i) is dangerous to human life or potentially destructive of critical infrastructure or ~~TEDE is the sum of the dose to the body from external radiation plus the total eventual risk equivalent dose from intakes of radionuclides. Note that where the term "dose" is used in this document, it is understood to be used as a synonym of TEDE.~~key resources; and (ii) is a violation of the criminal laws of the United States or any state or other subdivision of the United States; and (B) appears to be intended (i) to intimidate or coerce a civilian population; (ii) to influence the policy of a government by intimidation or coercion; or (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping **(13).**

3.1.46 *transport ~~index—~~index, n—*the dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during ~~transportation. The~~transportation; the transport index is determined by multiplying the maximum radiation level in millisieverts (mSv) per hour at 1 m (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour (mrem/h) at 1 m (3.3 ~~ft)).~~ft). **49 CFR 173.403**

3.1.47 *weapon of mass destruction ~~(WMD)—~~(WMD), n—*defined in U.S. law ~~(18 USC §2332a)~~ as a weapon meeting one or more of the following four categories: ~~(1)~~(1) any "destructive device" (such as explosives, incendiary material, or poison gas in a bomb, grenade, rocket, missile, or mine); ~~(2)~~(2) any weapon that is designed or intended to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals, or their precursors; ~~(3)~~(3) any weapon involving a biological agent, toxin, or vector; ~~(4)~~(4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

~~3.1.40.1 *Discussion—*~~

~~WMD is often referred to by the collection of categories that make up the set of weapons: chemical, biological, radiological, nuclear, and explosive (CBRNE). These are weapons that have a relatively large-scale impact on people, property, or infrastruction, or combinations thereof.~~ **~~CTOS 201~~18 USC §2332a**

3.1.47.1 *Discussion—*

WMD is often referred to by the collection of categories that make up the set of weapons: chemical, biological, radiological, nuclear, and explosive (CBRNE). These are weapons that have a relatively large-scale impact on people, property, or infrastructure, or combinations thereof **(19)**.

3.2 *Acronyms:*

~~3.2.1 *ABIS—*Arson Bombing Investigative Services~~

3.2.1 *AHJ*—Authority Having Jurisdiction

3.2.2 *ALARA*—As Low as Reasonably Achievable

3.2.3 *ANSI*—American National Standards Institute

3.2.4 ~~*ATF—*~~*ASHE—*~~Bureau of Alcohol, Tobacco and Firearms~~ Active Shooter/Hostile Event

~~3.2.6 *CBRN—*Chemical, Biological, Radiological, Nuclear~~

3.2.5 *CBRNE*—Chemical, Biological, Radiological, Nuclear, and Explosive

3.2.6 *CDC*—Centers for Disease Control and Prevention

~~3.2.9 *CEDE—*Committed Effective Dose Equivalent~~

3.2.7 *CFR*—Code of Federal Regulations

~~3.2.11 *CIA—*Criminal Investigative Analysis~~

~~3.2.12 *CIRG—*Critical Incident Response Group~~

3.2.8 *CRCPD*—Conference of Radiation Control Program Directors

3.2.9 *CTOS*—CTOS Center for Radiological/Nuclear Training at the Nevada National Security Site

~~3.2.15 *DCO—*Dosimetry Control Officer~~

3.2.10 *DHS*—Department of Homeland Security

3.2.11 *DOE*—Department of Energy

3.2.12 *DOT*—Department of Transportation

3.2.13 ~~*ECO—*~~*DRZ—*~~Exposure Control Officer~~Dangerous Radiation Zone

3.2.14 *EOC*—Emergency Operations Center

3.2.15 *EPA*—Environmental Protection Agency

3.2.16 *ERG*—Emergency Response Guidebook

~~3.2.22 *FBI*—Federal Bureau of Investigation~~

3.2.17 *FEMA*—Federal Emergency Management Agency

3.2.18 *FRMAC*—Federal Radiological Monitoring and Assessment Center

3.2.19 *FSLTT*—Federal, State, Local, Tribal, and Territorial

3.2.20 *GM*—Geiger-Mueller

3.2.21 *HZ*—Hot Zone

3.2.22 *IAEA*—International Atomic Energy Agency

3.2.23 *IAP*—Incident Action Plan

3.2.24 *IC*—Incident Commander

3.2.25 *ICP*—Incident Command Post

3.2.26 *ICS*—Incident Command System

3.2.27 *ICRP*—International Commission on Radiation Protection

3.2.28 ~~*ICS*—~~*ICRU*—~~Incident Command System~~International Commission on Radiation Units and Measurements

3.2.29 *IND*—Improvised Nuclear Device

3.2.30 ~~*JTTF*—~~*LDZ*—~~Joint Terrorism Task Force~~Light Damage Zone

3.2.31 *MACS*—Multiagency Coordination System

3.2.32 ~~*MIPT*—~~*MDZ*—~~Memorial Institute for the Prevention of Terrorism~~Moderate Damage Zone

~~3.2.34 *NCAVC*—National Center for Analysis of Violent Crime~~

3.2.33 *NCRP*—National Council on Radiation Protection and Measurements

3.2.34 *NFPA*—National Fire Protection Association

3.2.35 *NIMS*—National Incident Management System

3.2.36 *NIST*—National Institute of Standards and Technology

3.2.37 *NPP*—Nuclear Power Plant

3.2.38 *NRF*—National Response Framework

3.2.39 *OSHA*—Occupational Safety and Health Administration

3.2.40 *PAGs*—Protective Action Guidelines

~~3.2.43 *PPE*—Personal Protective Equipment~~

3.2.41 *PERD*—Personal Emergency Radiation Detector

3.2.42 *PPE*—Personal Protective Equipment

3.2.43 ~~*PRDs*—~~*PRD*—Personal Radiation Detector

3.2.44 *PRND/RND*—Preventive Radiological/Nuclear Detection or Radiological/Nuclear Detection

3.2.45 *R*—Roentgen

3.2.46 *R/h*—Roentgen per hour

3.2.47 *RDD*—Radiological Dispersal Device

3.2.48 *REAC/TS*—Radiation Emergency Assistance Center/Training Site

3.2.49 *RED*—Radiation Exposure Device

3.2.50 *REMM*—Radiation Emergency Medical Management

3.2.51 *RIID*—Radio Isotope Identifier

3.2.52 *SDZ*—Severe Damage Zone

3.2.53 *SI*—International System of Units

3.2.54 ~~*SOIC*—~~*SOP*—~~Strategic Operation Information Center~~ Standard Operating Procedure

3.2.55 ~~*TDS*—~~*SLTT*—~~Time, Distance, and Shielding~~State, Local, Tribal, and Territorial

~~3.2.54 *TEDE*—Total Effective Dose Equivalent~~

3.2.56 *TI*—Transport Index

3.2.57 ~~*TIS*—~~*US*—~~Terrorist Information System~~United States

~~3.2.57 *TKB*—Terrorism Knowledge Base~~

~~3.2.58 *TRACEM*—Thermal, Radiological, Asphyxiant, Chemical, Etiological, Mechanical~~

~~3.2.59 *TTIC*—Terrorist Threat Integration Center~~

3.2.58 ~~*UN*—~~*USC*—United ~~Nations~~States Code

~~3.2.61 *US*—United States~~

3.2.59 *WMD*—Weapon of Mass Destruction

4. Summary of ~~Practices~~Practice

4.1 This ~~standard~~ practice is based on existing resources and experience related to the development of radiological emergency response guidelines. This experience base is translated into a ~~standard~~ practice to guide responder agencies toward the goal of building operational guidelines for the ~~emergency phase~~first hours of radiological or nuclear incident response. The ~~standard~~ practice is intended to enhance the ability, knowledge, and understanding of personnel, agencies, or departments that are responsible for responding to a radiological or nuclear incident.

4.2 This ~~standard~~ practice shall be incorporated as a reference in ~~Emergency Operation Centers (EOCs),~~ emergency operation centers, emergency operation plans, and multiagency coordination systems ~~(MACS)~~ to assist in policy formulation and development of strategic objectives consistent with the objectives and needs of the ~~Incident Commander (IC)~~ incident commander throughout the incident. In incidents encompassing multiple agencies, multiple victims, and damage to environment and ~~infrastructure the EOC and/or MACS~~ infrastructure, the EOC or MACS, or both, would be operating at least at the local level. It is imperative that representatives at the EOC ~~and/or MACS~~ or MACS, or both, be aware of and understand ~~the standard practice,~~ this practice and operate in concert with emergency response communities that adopt ~~the standard practice~~ .this practice.

4.3 The flowchart shown in Fig. 1 summarizes the actions to take during a radiological or nuclear response. Note that, as discussed in Section 7, the default response to a nuclear detonation should be to immediately seek safe shelter, instructing members of the public to seek shelter as well. Once sheltering, emergency responders who have radiation survey equipment should use their instruments to assess radiation exposure rates outdoors and should respond in accordance with the decision points noted in Fig. 1 and discussed in Table 1. In a nuclear detonation incident, emergency responders who do not have radiation detection instruments should continue to shelter for 12 h to 24 h, until they receive radiation instruments, or are provided situational awareness of where the dangerous levels of radiation are present and where it is safe to respond, how to avoid lethal levels of radiation, and which locations are safe to conduct response or relocation activities (**5**). In contrast, during a response to a radiological (non-nuclear) emergency, responders are encouraged to conduct lifesaving activities as quickly as possible (even if no personal detection equipment is available), since it is unlikely that radiation levels are high enough to present an immediate hazard during a short period of time.

4.4 A discussion of the short- and long-term health effects of radiation exposure is found in Appendix X1, in Table X1.1, and Table X1.2.

4.5 This practice follows a risk-based response approach because the risk of developing short-term (for example, radiation sickness, skin burns) or long-term (for example, cancer) health effects is proportional to the amount of radiation dose received; because the amount of radiation dose received is related to the dose rate or exposure rate in which one works; and because radiological safety recommendations are provided in terms of reducing radiation exposure in accordance with the ALARA principle.

5. Significance and Use

5.1 It is essential for response agency personnel to plan, develop, implement, and train on standardized guidelines that encompass policy, strategy, operations, and tactical decisions prior to responding to a radiological or nuclear incident. Use of this ~~standard~~ practice is recommended for all levels of the response structure.

5.2 Documents developed from this ~~standard~~ practice should be ~~referenced~~reviewed and revised as necessary ~~and reviewed~~ on a two-year ~~cycle.~~ cycle or according to each jurisdiction's normal practices. The review should consider new and updated requirements and guidance, technologies, and other information or equipment that might have a significant impact on the management and outcome of radiological incidents.